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## BOOK NOTICES.

*La Face de la Terre*, by Ed. Suess, translated under the direction of E. De Margerie. Vol. II, 8vo, 878 pp.: Colin & Cie., Paris.

This work is a translation of *Das Antlitz der Erde*, by Ed. Suess, Professor of Geology in the University of Vienna. Volume I of the translation appeared in 1897. In the general preface contained in that volume M. Bertrand affirms that when the history of geology shall be written this work of Suess will be placed at that stage of the creative days when light was. This is no doubt extravagant; but we need not debate upon another passage of the preface—"A work of prodigious learning;" and we may well follow Professor B. K. Emerson—"A suggestion of Suess must be carefully considered, even if it be marvellous."\* No other work so fully summarizes the physical history of the globe, and its value for reference and study depends little upon the ultimate validity of even its main theories.

The thesis of the volume before us is, that widespread risings and fallings of the sea, rather than oscillations of the land, have, throughout geological time, controlled the changes of shore-lines and have been the landmarks of terrestrial history. The first chapter deals with the history of opinion on this subject. Among the authors quoted in support of the continental oscillation or secular movement theory we find: Playfair holding to real elevation of the land in Sweden; and Von Buch saying, after his researches in Lapland, "the level of the sea cannot sink;" these being later supported by the powerful authority of Lyell, Darwin, and Dana. But our author follows a long line of observers and speculators in asserting the mutability of the sea-level. De Maillet ascribed the retreat of the sea to progressive diminution of its volume; Swedenborg noted that the sea sinks more in northern than in southern regions, and gave clear expression to the doctrine of change of form in the liquid envelope; Cuvier, and Brongniart, arguing from alternations of marine and fresh-water deposits about Paris, believed in a primal sea, which retired, made way for fresh waters, and returned, to retire yet again; Robert Chambers thought that the English sea terraces might be due to the rising and sinking of distant sea-bottoms; Belt held to a swelling of equatorial waters; and Trautschold has not ceased to affirm, in the face of prevailing

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\* Bull. Geol. Soc. Am., Vol. XI, p. 93. Presidential Address.

opinion, that secular movements of continents are not real. It should be added that in this chapter, as throughout the volume, the references to the literature are full, exact, and of great value.

Extended chapters are given to an account of the form of the Atlantic and the Pacific shore-lines, and these are followed by detailed study of the ancient seas—Paleozoic, Mesozoic and Tertiary—showing the history of widespread transgressions and recessions in past ages.

Among the prevailing arguments for the theory of secular oscillation, we shall notice three, and observe the author's treatment of them. Of the proofs of continental elevation none has been urged with more confidence than elevated beaches, such as appear about the British Isles, along the shores of the Scandinavian peninsula, and in many other parts of the world. Where these are truly marine they may as readily be due to a rising sea as to a sinking land. But in the author's view suitable discrimination as to origin of these so-called elevated shore-lines has not been made. He devotes an extended chapter to the shore-lines of Norway. Petersen's observations in the neighborhood of Tromsø show fragmentary lines ascending, staircase fashion, as one goes up the fiords. Sexe pronounces contrary to the hypothesis of elevation because the height and number of beaches in the same fiord, or in different ramifications of the same fiord, are not invariable. In general, on the open sea the terraces are not far from the mouths of existing streams. In many side valleys of Hardanger fiord, for example, the number of levels varies from two to five.

Terraces often lead up to a moraine, which in turn has a lake behind it. Helland has shown that this association of moraines with terraces is true of nearly fifty of the chief lakes of the country. Most of the terraces of Norway must, therefore, in the author's view, be explained as evidences of the retreat of the glacier, the exception being in case of elevated beach-lines with marine shells.

The Baltic and North Sea are considered at length. Local or temporary influences are here efficient, also. As stated, for the Baltic we have atmospheric pressure, heating by the sun, ebb and flow due to winds, and, besides such seasonal changes, oscillations of a longer period, negative movement of the sea predominating.

Even fiorded coasts are not admitted as proofs of subsidence. Referring to such off-shore submerged channels as that of the Hudson, comparison is made with similar channels in Lake Geneva and Lake Constance, due, as the author holds, on authority of Forel and others, to recent erosion by deep currents. Likewise, the submerged

channel of the Congo is explained as due to sedimentary accumulation on either side. It is hardly needful for us to comment upon the difficulties entailed by such interpretation of the "drowned" margins of many lands.

For many years the remains of the Temple of Jupiter Serapis have stood as a classical proof of oscillations within historic time, or rather within the span of the Christian era. But our author will not allow this. It is but a local phenomenon. The movements here differ from those on the Baltic. They belong to the sudden and intermittent type:

They are changes which take place in the surface parts of a chimney clogged with ashes, and neither the fresh verdure of the hills and plains, nor the careless and light-hearted animation of the inhabitants, nor historic memories should let us forget that this "little corner of pleasant land," as Horace said, the Promontory of Misenum, lies in the abyss of a volcano which is extinct, but not wholly cooled.

While thus a strenuous attempt is made to break the force of the ordinary arguments for secular oscillations of the land, a much larger body of the work, even, is devoted to two positive considerations, which the author holds to be fatal to the generally received theory. Here we have, first, a comparison of the contours of the Atlantic and Pacific Oceans, and, second, the widespread and uniform shiftings of relative level in geological time.

The Atlantic and Pacific borders are reviewed in great detail. The Atlantic borders are compared, showing some differences and some striking correspondences. Thus, Greenland is taken as the axis of symmetry. Then, on the east, we find a chain of ancient gneiss extending from Lapland to the Hebrides, and on the west a jagged chain of gneiss from Davis Straits to the Straits of Belle Isle. On the east, likewise, is the great Baltic shield (Paleozoic), and on the west the Canadian shield. Other correspondences are the pre-Permian mountains of Ireland, Cornwall, and northwestern France, and the Appalachians. Also we find the two great Mediterraneans of the east and the west. Some elements appear in Europe for which there is no equivalent on the west. Such are the pre-Devonian Caledonian chain and the Pyrenees. Summing up (p. 331): with the exception of the Cordillera of the Antilles and of the mountainous fragment of Gibraltar, bordering the two Mediterraneans, the external border of a folded chain does not form any part of the contours of the Atlantic.

For the Pacific the facts are in strong contrast (pp. 334-5). With the exception of a fragment of the coast of Central America in Guatemala, where the turning Cordillera of the Antilles is sub-

merged, all parts of the Pacific border whose geology is known are formed by chains of mountains folded toward the ocean in such fashion that their external wrinkles serve as a limit to the continent itself, where they form a girdle of peninsulas and aligned islands.

This contrast between the two oceans as respects their continental borders is held to be inconsistent with the theory of secular oscillations, as are, further, the widespread and uniform transgressions and recessions of the sea during geological time. Such oscillations cannot explain the repeated submersions and emergings of the lands. The changes observed are far too extended and much too uniform to be able to proceed from movements of the solid crust. Thus the transgressions of the Cretaceous, observed upon the Amazon, Athabasca and the Elbe, on the borders of the Nile and in the Tarim Basin, in the valley of the Nabadá and in Borneo, on the isle of Sakhalin and upon the banks of the Sacramento—these are changes which have affected the entire surface of the planet. Similar is the evidence from Paleozoic times. The positive and negative phenomena alternate in the same epoch, and one is not able to explain this fact by the uprising of the land. During the Carboniferous and other periods the solid crust has undergone vigorous foldings; but these phenomena have nothing in common with these general changes of relative level. Here we have explained the possibility so remarkable, that we are able to use the same terminology to distinguish sedimentary terrains in all parts of the globe. The movements of the sea, to which changes of level are ascribed, are held to be oscillatory, and the principal cycles of oscillation embrace within their range minor or secondary cycles of change.

The author's theory must now be briefly outlined. Some areas of the sea-bottom sink and the water-level is drawn down; hence, though the sinking be local, the subsidence of water-level is general. The continental areas are left behind and bear the character of horsts.\* Such negative movements are relatively sudden. The chief fields of sinking were toward the south, and running down between them, where they merge, we find the pointed southern extremities of Africa, India, and Greenland.

But how are the positive movements explained? Here the tireless processes of denudation and transfer of land-waste to the sea are called forward. By this means the sea-bottom is aggraded and

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\* A horst is a region or block of country left at a considerable altitude by the subsidence of surrounding areas.

the water-level raised, this going on ever slowly, as distinguished from the more abrupt negative movements.

Many supplemental factors are cited, but hardly with such definiteness as to meet the conclusions of varied and refined observations upon changes of level going on in recent decades and centuries. Thus the height of the sea is said to depend on many conditions—solar heat, atmospheric pressure, prevailing winds, influx of fresh water, evaporation, local attraction, and many other circumstances. The average level is hard to determine, and needs a long series of observations. This is especially the case as regards the influence of winds, and, indeed, of all the meteorological factors. The tides, being periodic, can be eliminated. Actual dislocations or oscillations are admitted as occasionally occurring, as in the uplift by Cook Strait in the New Zealand earthquake of 1856.

This review has aimed only to set forth some of the chief points of Suess' theory, which are urged with great wealth of learning and illustration. Perhaps first among the objections that will rise in the mind of every American student will be the tiltings or differential movements of large areas, such as are demonstrated by the deformed ancient beaches of the Great Lakes or by the widely variant present altitudes of the Cretaceous deposits of the Great Plains.

A. P. B.

*A Reader in Physical Geography for Beginners, by Richard Elwood Dodge, Professor of Geography in the Teachers College, Columbia University, 237 pp.: Longmans, Green and Co.*

This little volume deserves attention at the hands of all teachers of geography. As stated by the author in his preface, only an account of the more important principles is attempted, the aim being to set forth the conditions of human life as depending on physical features. It is designed for use in connection with a text-book. In this manner it will supply new points of view and fresh illustration of many themes. Teachers who are still obliged to use antiquated text-books will find the Reader especially helpful as a supplement. This is the more true because the most modern views of the development of the lands are treated with simplicity and in entire avoidance of difficult or technical conceptions. The author has been successful in writing for beginners, and wholly avoids condescension in meeting his young readers.

The main topics are: The World as a Whole; The Continents; The Industries of Men; The Origin of Land-Forms; The Great